



ACTIONenergy



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Overview

Introduction

Monitoring and targeting (M&T) allows users to establish where they can make savings in utilities consumption by:

- establishing their sites' use of utilities
- comparing this with variables that affect consumption
- comparing this consumption fairly by taking account of variables that affect it.

The main benefit of M&T is that it quickly alerts users to irregular patterns of consumption.

Other benefits include:

- understanding usage patterns
- identifying peak usage times
- identifying high users or leaks
- supporting arguments for obtaining funding to introduce energy efficiency measures
- keeping track of utility supplier data.

Computerised M&T packages can make the process easier and more efficient in a number of ways:

- cost and consumption data can be kept together, so the information is easier to access and manage
- interface with BEMS may be possible, allowing automatic reading of meters
- you can report quickly on consumption, cost and emissions
- a single database can be a good aid to procurement.

It may be easier to tailor outputs such as consumption reports to your exact needs, so you can find out about individual sites or buildings.

Common applications for computerised M&T systems include bill checking, storing procurement information, identifying high usage patterns as they arise or administering devolved budgets.

How to use this guide

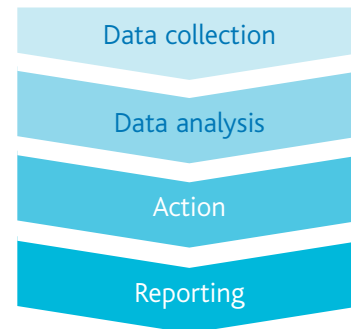
This guide contains information on the kinds of features that are available from M&T software, as well as issues that should be considered during specification, such as cost, availability of resources, and integration with existing systems.

The guide will be of interest to people within higher education institutions whose responsibilities include managing their sites' utilities consumption. These may be either dedicated energy managers, or engineers for whom management of utilities forms only a part of the job.



Through bill validation, one institution, which installed M&T software five years ago, has made cumulative savings of hundreds of thousands of pounds on utilities charges that are around £4 million per year. Another establishment saved £45k over a period of three years.

What is the M&T process?



The aims of a good M&T system should be to:

- establish historic consumption patterns
- compare current consumption with historical data/benchmarks
- set future targets
- compare actual consumption with targets
- identify trends in consumption.

M&T process

The general monitoring and targeting process consists of distinct stages and can be summarised as shown in the flow-chart (above).

The first step of any M&T system is to establish the existing level of usage for each utility on site. This can be achieved by checking supplier invoices and/or taking regular meter readings.

You should compare your current consumption figures with any historical site data. This will allow you to determine whether consumption has increased when compared with the same period in the previous month or year. It is important that the data has been normalised so that equivalents are being compared. For example, you could use a degree-days regression technique (see Good Practice Guide 310).

The data can also be examined alongside appropriate benchmarks, to show how your site is performing in comparison to other, similar sites.

With the trends you identify, you will be able to set future targets for your site.

Selecting a system

Computerised M&T systems

It is possible to carry out M&T using a computerised system to assist. These can range from simple spreadsheets and databases put together in-house, to log meter readings and invoice details for comparison, to specialised software that can help you to set benchmarks and produce customised invoices and reports.

Simpler, self-designed systems are most useful if your sites metering is quite straightforward, and the utilities bill is not particularly large or complicated. However, if your site is larger or more complex (i.e. you have a large number of meters), or your bills are higher, a commercial package can be more efficient and easier to use. It also has the advantage that the software is continually being developed, and the graphics and facilities are better tailored towards your purposes.

University sites are often quite complex, and whether all the buildings are grouped together on a campus or spread out across different sites, the activities taking place in them can have quite different energy requirements. It can, therefore, be beneficial to invest in a suitable M&T package that allows you to manage the consumption data from such a variety of buildings.

Irrespective of the size of your site, the main priority should be to identify and implement a system appropriate to your requirements and resources.

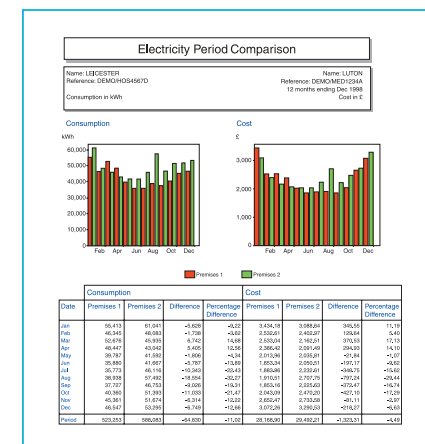
Introduction

There are many proprietary M&T packages available. They have a variety of features, and it can be quite difficult to understand the differences in them. Costs will vary depending on the manufacturer, the software facilities and what kind of infrastructure the system requires. You should choose a system with the correct level of features and think about what your requirements are before purchasing.

What is available?

M&T packages can usually be tailored to fit the requirements of an individual site or user. Basic features of any M&T software include the following:

- **Bill validation**
Using the software you can check supplier invoices against your own meter readings to make sure that they are error free. Validation can save significant amounts of money and can usually be accomplished quite easily if the unit cost for each utility is entered.
- **Flagging anomalies in consumption**
Most software can be set to flag up any unusual increases in consumption so that these can be investigated and corrected if necessary. Parameters for this are normally set by the user.



Consumption data for an estate

• *Producing reports*

Reports can be produced to show details of cost or consumption for a period of time. A visual representation of consumption can help you see where savings could be made, whilst cost reports will allow you to see how much is spent on each utility.

Even basic software can produce simple consumption reports, although in many cases there may be no features which allow the format of these outputs to be customised. Upgrading to a more advanced version means that the user will be able to produce customised reports. When specifying even a basic system therefore, you should consider whether you will need to tailor your reports according to who will see them.

Common report formats include graphs and tables of consumption, and adjustments can usually be made to show data for specific periods. With more sophisticated software, parameters can be set to vary performance indicators according to factors such as weather, population, floor area and night-time use etc., so that the energy consumption of different building types and sizes can be compared.

Often reports can be generated automatically and some systems will automatically e-mail reports to end users.

Most of the software available will allow you to produce graphs similar to those illustrated in this guide. This will enable you to compare data from different buildings or sites.

• *Other features*

Many systems can be set up to interrogate meters or loggers directly to collect real-time data, so no manual checking of meters is required. Often, the intervals at which the software interrogates the loggers can be set by the user.

If you have a BEMS and you want your M&T system to interface with it, this is something which you will need to specify from the outset, as not all packages will necessarily have this capability or be compatible with your particular type of system.

Questions to ask the manufacturer

- What are the features of the most basic package?
- What functions can I specify in addition to these?
- What kinds of outputs can the software generate?
- Can I customise these?
- Will the software integrate with my current computer network?
- Is it compatible in its current format with my existing BEMS/spreadsheet system?
- Will it integrate with my existing metering infrastructure or will I have to change or update this?
- What equipment will I need to automatically interface with meters or BEMS?
- What kind of input data will I need?
- How long will it take me to input the data needed before I can start using the system?
- What kind of training will I need to use the software?
- What kind of IT support will I receive from the company?
- Are there proven cost benefits from other users?

Potential costs

How much a system costs, both in terms of initial outlay and running costs, can vary depending on a number of factors.

Initial cost

The initial cost can range from hundreds to thousands of pounds for a single system. Price can be determined by choice of supplier – bigger, better known brands can be more expensive than software from smaller manufacturers. However, software available from smaller manufacturers may, for example, incorporate fewer features. It is worth investigating a number of packages from different suppliers to see what each offers.

The cost of any M&T software also depends very much upon the size of your site, since this dictates what the system will need to do. The size of your utility bill and the potential to reduce it are important factors which will affect the length of the payback period. Other costs, such as changes, updates or additions to your metering infrastructure need to be considered.

Running costs

Running costs usually include things like the annual subscription fee, which is designed to cover IT support, maintenance and software upgrades. These fees can vary greatly, from a couple of hundred pounds up to a thousand pounds per year.

You should remember to take staff time into consideration as a potential running cost, and if you are planning to network your M&T system, it is also a good idea to investigate whether the system will incur extra licensing costs.

Preparation and infrastructure

It is important to consider the features of your site that could affect the way your new M&T package runs.

Compatibility with current systems

Most monitoring and targeting software available is compatible with Windows™ and so can be installed on the PCs found in most offices. However, it is important to check whether your software needs to run on its own PC, as this could mean the existing network needs to be updated.

If you require the software to link up with any existing energy management systems, you will need to think about the degree to which the two systems should integrate.

For example, if you have been recording historical data in a spreadsheet, it is a good idea to find out what will be involved in making this data available to your new software, since it will be very useful for setting targets.

You should find out how easily data can be exported from report outputs to other formats, as you may need to manipulate it – for example, to customise reports more than the software allows.

You should also consider how you will input consumption data into the software. For example, if you select software that interrogates meters and data loggers directly in order to collect data, you should also check whether your sites metering infrastructure can integrate with it.

Costs to consider

- Initial outlay for software
- Possible expenditure on licences
- Cost of updating current metering
- Infrastructure
- Cost of adding more meters
- Subscription to manufacturer for maintenance, IT support
- Additional fees for upgrades and extra licences
- Cost of any training
- Staff time

Factors affecting cost effectiveness

- Cost of the system
- Potential for making savings on site, e.g.
 - large or complex site
 - high utilities bills
 - high base load
 - exceeding maximum demand
- Current metering and computer infrastructure on site, and whether this will require:
 - upgrades
 - additions





Of the three different types of meters one university had on site, they could adapt their software to receive information from only two of them. The university had to pay to get the third type of meter linked to the system.

Points to consider

Clarifying exactly why you are installing an M&T system will help you to work out what you need from it.

- **What are my aims?**
These might include saving energy and money; having greater control over energy use and budgeting; the implementation of a devolved budget; and identifying services where there is spare capacity/redundancy.
- **How big is my site?**
The bigger or more spread out your site is, the more advanced your M&T software will potentially need to be to cover it effectively.

- **What kind of infrastructure do I have in place?**
Consider whether your current metering infrastructure can provide you with a detailed enough level of data for your purposes and ensure that the format of the data can be processed by your software.
- **What staff are available to you?**
Think about whether you have the human resources needed to run your M&T system efficiently. A lack of staff will mean you may not get the most out of your system.
- **Do my staff and I have the right skills?**
It is worth considering both the IT skills and energy management knowledge of anyone who will be involved with running the system, as this may affect whether you can specify a more advanced package.

Some software can only receive or process information supplied in a certain format or by certain devices (e.g. loggers). If the two are initially incompatible, it may be possible to adapt the software to receive data from your existing system, or to adapt your metering so that it can link to the software.

Ask the manufacturer to demonstrate the software on an example of every kind of meter on the site, in order to see what it involves and how long it is likely to take with each.

Another important aspect to investigate before you purchase M&T software is the amount of data you will need to input into the system to start with. Some systems may require a great deal of data to be input before you can begin using them and, if this has to be done manually, it could take a considerable amount of time and staff resources before your system is ready.

When setting up an M&T system, you should ideally have a certain amount of historical data to begin with, even if this consists purely of supplier invoices. It will enable you to start identifying potential savings more quickly, which could reduce the software's payback period.

Available resources

The resources you have to devote to running the system will be a factor in deciding which package to choose.

Data input can take up time that could otherwise be spent investigating and taking action. If you do not have a great deal of time or many staff, or your site is particularly big or spread out over a large area, taking manual meter readings

and inputting these into your software by hand may be impractical. In this case it may be worthwhile considering software that can obtain data directly from meters.

A lack of resources can also mean that it may be difficult to act on information obtained through M&T. It is therefore important to consider carefully how much information you want so that all the data you get from your system can be put to use.

Software that can capture half-hourly data from your meters will save time on reading meters, but there may be a great deal of data to process and follow up. You should consider whether you have sufficient staff to act on this information and enough resources to fund any improvements you might need to make.

If your site is quite big or you lack the staff to follow up more detailed information, a system which flags anomalies will allow you to concentrate on areas that need the most attention, as unusual increases anywhere will be picked up automatically by the system.

As an initial step, collect data from main meters only. You can expand your system as you become more familiar with your software and how it operates and begin to identify areas where there may be the potential to save money.

Generating reports is another area that can be quite time-consuming. Think about whether end users are interested in receiving these kinds of outputs, and if so, which formats will be of most use to them.

Training

Most manufacturers recommend training options with each package, which can vary in length from 2-3 hours to 2-3 days. The longer courses and workshops tend to be available at an additional cost, whilst basic training is usually provided as part of the initial package.

It is useful to find out exactly what training is offered as a basic part of any package, since it may not fully meet your needs. It is also worth investigating whether you can delay receiving the training until you have had time to try the software out for a while, since it may be more beneficial for you to know in which specific areas you need the most help.

It is also important to be aware of the IT capabilities of the people who will be responsible for running the software. If they lack IT skills, a more sophisticated system will not be used to its full potential. With less

advanced software, however, options are often more limited and functions simpler, so they are more straightforward and easier to learn.

The level of training each member of staff needs will also be affected by the purpose for which they are using the software - for example, data entry may require less training than generating invoices or reports.

Bureau services

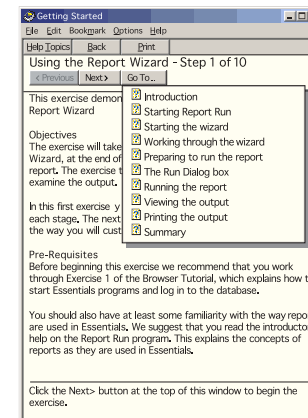
If you feel you lack the in-house resources, expertise in energy management or IT skills to run your own M&T system efficiently, or would like the security of being able to draw on the skills of the M&T supplier, it may be worthwhile using a bureau service. This is where various aspects of the administration of an M&T system can be contracted out to another company.

Bureau services are offered by many manufacturers, and can be tailored to the requirements of an individual client. Facilities range from data collection, analysis and reporting to simple bill validation. In many cases the internet now means you also can access your sites data online as necessary.

If you decide to use a bureau service, you will still need to work out exactly what you want from your M&T system so that you know what you want them to provide - for example, will they flag anomalies, set benchmarks and monitor the sites consumption accordingly or will they simply run off reports, with examination of these outputs taking place in-house?

You should also consider how you will get your data to the bureau, including its format (based on invoices or meter readings) and the time it will take to input everything if you do not have electronic data transfer capabilities. The frequency of information you require from the bureau and what format will be of most use to you are two more points to take into account.

Although M&T companies are experts on their software and M&T system, the company will be unfamiliar with your site and how it works, and it may be remotely sited.



Example of a tutorial screen

Getting the most out of your system

Data collection

The data you collect for M&T must be accurate and detailed enough for your purposes.

Meters

Reading meters is an activity that can take up a great deal of time, especially if your site is particularly large or consists of a number of buildings at different locations. The frequency with which they are read (i.e. monthly, weekly, daily) also contributes to how long you need to spend on this activity. Meters that can be read remotely by your system cut down on this time.

However, the reliability of hardware such as meters themselves, as well as data loggers and so on, is extremely important to ensure the quality of data. Obviously, the way in which this data is supplied also needs to be compatible with your system.

Hand-held computers can considerably lessen the time needed to read meters manually. The data is uploaded onto the hand-held, and then downloaded into the system when all the meters have been read. This not only saves time, it can also avoid the mistakes and typing errors that could occur when taking readings and inputting data manually.

Some suppliers may be able to send their readings and invoices electronically to your system, which can also save a great deal of time that would otherwise be spent inputting invoice information manually for the purposes of bill validation.

However, if supplier information forms the basis of your monitoring and targeting activity, it is important to remember that any estimated readings or mistakes on the part of the supplier will affect what kind of picture you get of your sites energy use.

Maintaining the database

It is important to be consistent in collecting data if you are to build up a reliable picture of energy use on your site.

You will need to maintain the database by taking readings at regular intervals; this will enable you to build up a history of your sites consumption, which will provide a basis for setting realistic targets to reduce consumption in the future. However, it is important not to be overloaded with data, as you will spend time on information that you cannot follow up.

The amount of data you need will depend on a number of factors, such as the availability of human resources and the size of a site and the buildings within it. For example, if your site is particularly big or its layout complicated, it may be worthwhile getting half-hourly data from your meters, whereas for smaller and/or simpler sites, monthly data may suffice.

You should also check the information in your database regularly for errors.

The energy manager at another institution input and checked two years' worth of historical data when he first got his M&T software, so that he immediately had a basis for checking anomalies and setting targets.

BEMS

Just as meters need to be both reliable and compatible with your M&T systems, if you want to link your BEMS to your M&T system it is also important firstly to check that it is compatible, and secondly to consider how reliable it is, both in terms of the data it supplies and in carrying out instructions.

Although most systems can be integrated with BEMS, this function is sometimes limited to specific types of BEMS or those that supply the data in a certain way. For example, if you are relying on your M&T system to link to the BEMS and send instructions when, for example, it detects a leak, it is important to be sure that the relevant command has been carried out.

At one university, monthly data from the BEMS is entered manually to the software. However, the data from the BEMS is often not reliable, which would be a big problem if the system had electronic data input capabilities.

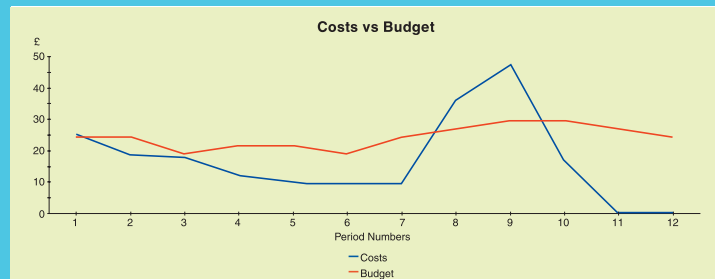
The screenshot shows the 'LUTON - Data Entry' application. The main window displays a 'Data Entry Grid' with columns for Date, Est, kWh/Day, kWh/Night, and kWh/Total. The data spans from 31/03/97 to 30/06/98. A 'Supply' window is open, showing details for 'Luton Electricity' with fields for Name, Account Number, Meter ID, Supply Number, Billing Cycle, Tariff Details, Distribution Area, Meter Operator, Generation Date, and Change due to.

| Date | Est | kWh/Day | kWh/Night | kWh/Total |
|----------|-----|----------|-----------|-----------|
| 31/03/97 | N | 63,284.0 | 17,755.0 | |
| 31/04/97 | N | 66,447.0 | 19,766.0 | |
| 30/05/97 | N | 57,479.0 | 17,067.0 | |
| 31/05/97 | N | 63,900.0 | 18,510.0 | |
| 30/11/97 | N | 60,747.0 | 17,876.0 | |
| 31/12/97 | N | 64,533.0 | 18,944.0 | |
| 31/01/98 | N | 67,622.0 | 19,262.0 | |
| 29/02/98 | N | 57,415.0 | 16,687.0 | |
| 31/03/98 | E | 61,172.0 | 18,142.0 | |
| 30/04/98 | N | 49,470.0 | 15,403.0 | |
| 31/05/98 | N | 48,454.0 | 15,711.0 | |
| 30/06/98 | N | 49,930.0 | 14,984.0 | |
| 31/07/98 | N | 50,250.0 | 14,013.0 | |
| 31/08/98 | N | 44,694.0 | 12,891.0 | |
| 30/09/98 | N | 43,607.0 | 12,870.0 | |
| 31/10/98 | N | 49,341.0 | 14,382.0 | |
| 30/11/98 | N | 50,385.0 | 13,445.0 | |
| 31/12/98 | N | 50,146.0 | 13,965.0 | |
| 31/01/99 | N | 50,128.0 | 13,372.0 | |
| 29/02/99 | N | 47,148.0 | 13,336.0 | |
| 31/03/99 | N | 47,552.0 | 13,496.0 | |
| 30/04/99 | N | 39,863.0 | 10,968.0 | |
| 31/05/99 | N | 39,050.0 | 11,104.0 | |
| 30/06/99 | N | 40,884.0 | 11,159.0 | |

Data entry grid

The 'Search Criteria' dialog box is shown, allowing users to search for specific data. It includes fields for Supply Reference, Supply Name, Account Number, Billing Cycle, Utility, Supplier Name, Tariff, Tariff Category, and Meter ID. The 'Tariff Category' is currently set to 'Maximum Demand'.

Data search



Keeping track of energy costs

Running your system effectively

- Check the reliability of the hardware you will use to obtain your data.
- Consider how you will collect data.
- Take regular readings to ensure information is consistent.
- Ensure the amount of data you get is appropriate to the size and complexity of your site and will allow you to obtain a good picture of its energy use.
- Make use of the information to compare your sites performance to benchmarks and set targets using historical data.
- Communicate with others on your site who may be in a better position than you to act on your information.
- Make use of the information to help you promote energy efficiency to end users.

- Make use of the information to compare your sites performance to benchmarks and set targets using historical data.
- Communicate with others on your site who may be in a better position than you to act on your information.
- Make use of the information to help you promote energy efficiency to end users.

Communicating information

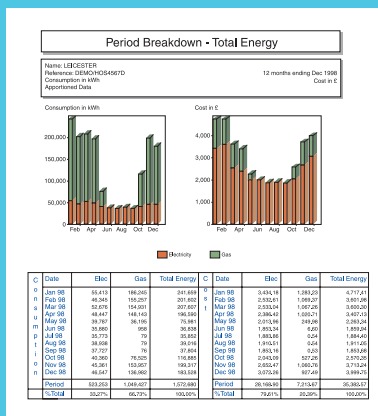
It is important to communicate M&T information to others on your site, as they may be better placed to take immediate action to reduce consumption through simple housekeeping measures and so on. However, you should think about the format of any reports or other information you send out so that they can be understood by the people that will be reading them.

If your M&T package has features that enable you to customise the format of outputs such as graphs, tables and invoices, these tools are useful if you need to disseminate information amongst a varied group of people. The level of detail in the reports and whether figures show consumption or cost are also features which can be adjusted on most systems according to the intended audience.

If you need to distribute copies to a large number of people, it may be useful to also have a package which offers facilities to email out reports automatically.

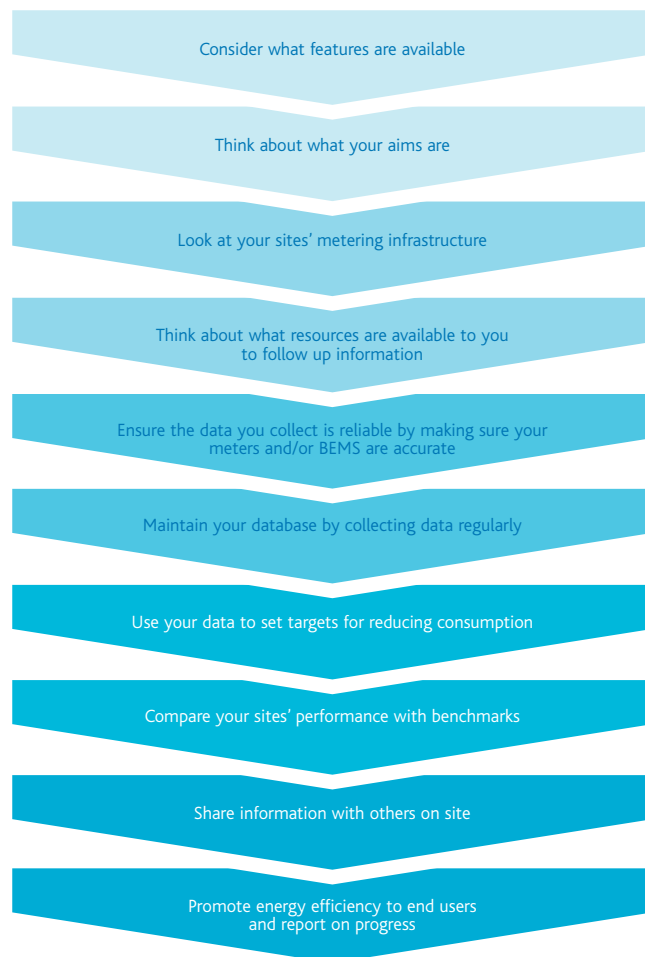
Promoting energy efficiency

Reports, graphs and other information can be important tools in raising awareness and promoting energy efficiency on-site. They can not only be used to keep end users informed, but can also support arguments for, and demonstrate the effectiveness of, the introduction of energy efficiency measures.



Step-by-step approach

The flowchart below details a step-by-step approach to specifying a system and using it to its full potential.



Further information

Monitoring and targeting systems for Universities. Other useful publications within the Action Energy programme include:

ECG054: Energy Efficiency in Further and Higher Education – cost-effective low energy buildings – The Guide provides a method for assessing energy usage and costs in a range of academic and residential buildings, and will also help senior managers to understand the role that energy plays in the operation of their institution.

ECG081: Energy Efficiency Benchmarks for Heating and Internal Lighting in Industrial Buildings – includes a CD-ROM guide which is designed to provide ways of assessing the performance of a building, to identify what potential exists for making savings and to point the reader towards the most likely cost saving measures.

EEB005: Introduction to Energy Efficiency in Further and Higher Education – aimed at university bursars, site engineers, facilities managers and others with responsibility for energy use in university and further education buildings. It presents an overview of the subject of energy management and recommends the use of an action plan to achieve energy cost savings.

GPCS150: Energy Management: Manchester University – looks at the energy efficiency measures implemented by the energy unit at the university.

CPG232: Educated Energy – Good Housekeeping in Further and Higher Education Buildings – to help energy managers in higher education to convey the message about good housekeeping.

GPCS336: Energy Efficiency in Further and Higher Education – Monitoring and Targeting – A Good Practice Case Study looking at the implementation of M&T at the University of Wales.

GPG207: Cost-effective Low Energy Buildings in Further and Higher Education – The Guide is intended for estates managers and academic department managers, working in further and higher education, and looks at the financial benefits of introducing energy efficiency measures into buildings, both new and refurbished.

GPG246: Building Management Systems in Further and Higher Education – This guide is aimed at estates and finance managers and it covers the features, benefits and key steps towards a BMS installation, and outlines some of the funding options.

GPG310: Degree Days for Energy Management – A Practical Introduction – This guide introduces the use of degree day analyses as part of a wider energy management programme.

They can be obtained from the Action Energy Helpline on 0800 58 57 94, or via the website, www.actionenergy.org.uk.

The CIBSE Guide to Energy Efficiency in Buildings can be ordered online at www.cibse.org.

Useful websites include

FHE Energy Efficiency: www.bham.ac.uk/energy-consortium/fhe (including the devolved budgeting guidance) – for energy managers and building designers in the higher and further education sector. It contains publications on energy-related topics, links to benchmarking studies and a networking service as well as guidance on setting up and implementing a devolved budget.

The Energy Consortium: www.bham.ac.uk/energy-consortium – with a newsletter; news and updates on issues affecting energy purchasing within the higher education sector (e.g. the climate change levy); price information and forecasts; a forum for problem-solving.

The higher education funding councils for England, Scotland and Wales: www.hefce.ac.uk; www.shfc.ac.uk; www.wfc.ac.uk – for information on procurement and value for money studies, as well as the Estates Management Statistics report found on the HEFCE site, which aims to encourage uniformity in information management.

HE Estates site: www.heestates.ac.uk – details current initiatives; gives profiles of partners; offers resources such as advice, publications and training, and links to a discussion group.

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Important Notice

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